

THE EFFECT OF OLIVE WASTES FOR POULTRY FEED ON GROWTH PERFORMANCE OF BROILERS: A review

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The increasing demand for animal products has increased the demand of feed ingredients around the world. However, the decrease in natural resources, cultivated lands, and resulted in continuous supply of feed ingredients. For this reason, studies on alternative feed ingredients are the main interest of scientists. Olive industry by-products are one of the major environmental pollutant and these by-products could be potential alternative feed ingredients for livestock /poultry industry. Studies have reported that the reuse of olive by-products in broiler feeding has an impact on environmental, economic and growth performance. Current review will provide the information that olive industry by-products can be used efficiently in broiler feeding. It will also contribute to the elimination of environmental problems caused by the breakdown of such wastes in the environment. However, maintaining the nutritional value, preservation methods and feed incorporation level in order to include these unconventional feed sources in the diet of farm animals is another problem that needs to be studied. This study will provide the evidence that olive industry by-products not only will increase the growth performance of broilers, but increase the olive industry profit and reduce environmental pollution.

Keywords: leaves, olive, pomace, pulp, waste recycling.

INTRODUCTION

Innovation in agriculture concept aims at a “zero waste” economy, where new products and applications are created from raw material waste (Mirabella *et al.*, 2014). However, rapidly developing poultry farming significantly increases feed consumption and feed costs. In the poultry industry, approximately 70 percent of the production cost consists of feed costs. For this reason, various researches are carried out to meet the increasing feed requirement and reduce the feed cost. One of the important issues emphasized in these studies is to investigate the potential of alternative feed sources that can be used in poultry nutrition. The use of foods that can be consumed as human food in animal nutrition is not recommended because it creates consumption competition between humans and animals. By-products released during the harvest and processing of olives, which have played an important role in healthy nutrition in Mediterranean countries and Turkey for years, could be potential alternative feed ingredients for poultry industry. In recent years, the olive sector has shown a rapid development and a large amount of olive products are being produced which are also resulting an increase in the amount of by-products that causes

environmental pollution. During the processing of olives as oil, by-products such as olive leaves, olive black water (waste water), olive pomace or olive pomace are produced. Previous studies on the possibilities of using these by-products in animal nutrition and obtaining the results have shown effective economic benefits and potential alternative feed sources (Keser *et al.*, 2010). Previous studies have explored that supplementation of olive industry by-products in broilers diets does not have any negative effects at certain level, however, higher level may have negative influence on growth performance parameters (Sayehban *et al.*, 2016). The negative effects on growth performance at higher level of addition of olive industry by-products could be due to non-purification of olive industry by-products. Recent studies have demonstrated that purification of various bioactive compounds found in olive by-products, and supplementation of purified olive oil by product may improve animal health and performance (Liehr *et al.*, 2017; Leskovec *et al.*, 2018). Moreover, olive by-products may be characterized as antibiotics, antimicrobial, antioxidant and anti-inflammatory that could also helpful for good health and growth performance in broilers (Niewold, 2014; Lillehoj *et al.*, 2018). Similarly, previous studies had reported that addition of olive

waste to broiler rations has a positive effect on microbial and immunological parameters (Rizal *et al.*, 2010; Faiz *et al.*, 2017). In the light of previous studies, the effects of olive waste on the growth performance of broiler chickens are discussed in this review.

Use of Olive Waste in Poultry Feeding and Growth Performance: Olive is used lovingly by people with the beneficial oil and fatty acids it contains. Due to this content, it has been shown in studies that the use of olive waste as animal feed does not cause a negative situation. Olive contains several antioxidants that potentially scavenge free radicals and provide antioxidant protection, and olive waste is used as an alternative feed ingredient to reduce feeding costs (King *et al.*, 2014; Gerasopoulos *et al.*, 2015).

Olive leaf: Olive leaf is waste with the same beneficial qualities as olive oil, and had lean and in higher concentrations of various nutrients. In addition to these, antioxidants in the olive leaf structure, make it more useful to be used in the poultry diet to protect from the activity of free radicals (Elsaed *et al.*, 2014).

It has been reported that olive leaf waste added to chicken feeds in different amounts ($0 > 30 = 50, 0 = 15 > 50$) significantly reduced body weight gain ($P < 0.05$) and ($P < 0.01$) kg diet) in chickens (Shafey *et al.*, 2013). In another study using 120 Ross 308 broilers, the researchers found that olive leaf supplementation had no significant effect on the growth performance of the broilers when they compared the olive leaf-containing feed mix using 5% or 10% olive leaves with the control group. In another study, it was reported that 5% and 10% olive leaf added to the diet did not have a significant effect on growth performance, however, adding 10% olive leaf waste did not change the mineral content in the bone, but increased the Cu content in the humerus. As a result of this study, it was shown that the addition of olive leaves to the ration did not adversely affect the growth performance of broilers (Pecjak *et al.*, 2020).

In the study in which 200 Ross 308 chickens were used for the growth performance experiment, 250 mg of olive leaves for the negative and positive control groups and 200 or 400 mg of olive leaves were added to the rations of broiler chickens. As a result of the study, it was reported that there was no difference in weight gain, feed intake and feed conversion ratio when the feeds consisting of control and olive leaf waste were compared (Agah *et al.*, 2019). Similarly, in other study, researchers used two hundred and forty Arbor- acre broilers in the experiment and were given varying levels of olive leaves extract (OLE) (0, 5, 10, or 15 mL), and the experimental result of 15 mL of OLE was total weight gain (TWG) and final weight (FW) were higher relative to increase in birds in the other treatment groups. Therefore, it has been reported that the addition of 15 mL of OLE improves the performance of broilers (Oke *et al.*, 2017).

Olive Pomace: Pomace (OP) is a good functional compound that is formed as a result of processing with olive oil and

contains simple phenolic, polyphenols, oleuropeosides and flavonoids. Pomace is relatively rich in water, high fiber content (lignin, cellulose, hemicellulose and pectin) and oil, especially most of the unsaturated fatty acids (Liehr *et al.*, 2017; Fathy *et al.*, 2018). In a study of 306 1-day-old chickens, they reported that bioactive olive pomace extract (750 ppm) added to chicken feed improved animal growth (Encinas *et al.*, 2020). In another study on pomace, the effect of the treatment on body weight was found to be significant only on the 28th and 35th days. In the same study, it was reported that the addition of 5 g/kg olive leaf added to the mixed feed provided higher body weight than the control group on the specified days (Yavaş, 2013).

In a study comparing the 5%, 10% and 15% olive pomace group added to the feed and the control group, no difference was found between the 5% OP (Olive pomace) and 10% OP groups in terms of body weight gain and feed consumption in the initial period. However, in the same study, a linearly lower body weight gain (76.53 g) was reported when the control group (live weight 844.64) and the group containing 15% olive pulp (OP) (body weight 768.11) were compared ($P < 0.05$) (Tüzün *et al.*, 2016).

Olive pulp: Olive pulp (OP) contains various active compounds (antioxidant, antifungal and antibacterial) in its structure (Santini *et al.*, 2017; Huang *et al.*; Alves *et al.*, 2019). In the studies examined, it is suggested that the addition of olive oil pulp in 50 and 100 gr/kg amounts to the feeds does not change the high carcass characteristics and that these wastes should be added to the feeds (Sayehban *et al.*, 2020). In another study, conducted with olive paste supplemented to broiler rations at different rates (0, 2, 4, 6 and 8%), it was reported that there was no significant difference in the growth performance of broiler chickens. However, in the study, it was reported that enzyme supplementation is not required to achieve high growth performance as a result of using olive pomace. (Sateri *et al.*, 2017). In the study investigating the effects of two types of olive pulp (5% and 10%) on the performance of broiler chickens (with and without enzymes), it was reported that there was no significant effect between the amounts of olive pulp (Sayehban *et al.*, 2016).

Other Olives Waste in Poultry Nutrition: There has also been an increase in olive tree planting due to the increase in olive oil production due to both its use as food and its benefits. Olive cake is one of the other olive oil extraction by-products (such as olive leaves and olive pulp). (Al-Harthi, 2014). In a study with olive cake, it was shown that adding up to 10% of olive cake (OC) without adding enzymes to broiler rations does not adversely affect chicken performance. This indicates that diets containing up to 10% OC provide sufficient nutrients for growth performance (Al-Harthi, 2017). In the study conducted with 480 one-day old broiler chickens (Ross 308), normal feed was given to the control group, while the second to fourth groups were given maize feed containing 5%, 10% and 20%. It has been reported that chickens fed 5%

and 10% OCM showed better body weight ($p=0.04$) and feed conversion ratio ($p<0.048$) than those fed 20% OCM (Saleh *et al.*, 2021). In the study investigating the effects of adding 0.5%, 5% and 10% olive pulp (OC) to 1-28 days old broiler rations, 0.2 and 0.4 $\mu\text{g}/\text{kg}$ unleavened or fermented (*Saccharomyces cerevisiae*) was added to each OC amount. It has been reported that 0.4 $\mu\text{g}/\text{kg}$ yeast supplementation results in the best body weight gain. In addition, it has been reported that up to 10% of OC can be safely given to chickens 1-28 days old, and environmental pollution resulting from OC accumulation will decrease as a result of olive oil extraction Al-Harthi, 2016.

Conclusion: Today, while the cost of poultry ration is increasing, animals are competing with humans for food and therefore some waste parts of olive that are not consumed by humans are recommended to be used as an alternative source of feed additives in poultry. Since olive by-products can be added to broiler rations without affecting their aroma, digestibility, nutrient content, health or performance, rations are applied after applying appropriate processing methods, and the effective and efficient use of these by-products will reduce feed costs and will be profitable for businesses. It has been concluded that the inclusion of these wastes as a feed component in poultry rations by using appropriate processing methods will contribute positively to the growth performance of broilers, and will help reduce the overall cost of poultry production and environmental pollution. Olive by-products can be used as animal feed without affecting flavor, digestibility, nutritional content, health or performance. In different studies, the addition of olive by-products to the livestock diet had beneficial effects on the growth performance of broilers. For this reason, the use of olive waste as an alternative feed additive in poultry rations after applying appropriate processing methods will undoubtedly bring many results (such as a decrease in production costs, increase in broiler growth performance, decrease in environmental pollution).

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